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IS 15213 (2002): Specification and Characterization Methods for Nonwoven Para-Aramid Reinforcement [LITD 5: Semiconductor and Other Electronic Components and Devices]

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बिना बुनाई की पारा-आरमिड प्रचलन की विशिष्टि और विशेषताएँ

Indian Standard

SPECIFICATION AND CHARACTERIZATION METHODS FOR NONWOVEN PARA-ARAMID REINFORCEMENT

ICS 31.180

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 2002 **Price Group 6**

Printed Circuits Sectional Committee, LTD 17

NATIONAL FOREWORD

This Indian Standard which is identical with IEC/PAS 62213(2001) 'Specification and characterization methods for nonwoven para-aramid reinforcement' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Printed Circuits Sectional Committee and approval of the Electronics and Telecommunication Division Council.

The text of the IEC/PAS document has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

The technical committee responsible for the preparation of this standard has reviewed the provisions of the following International Standards and has decided that they are acceptable for use in conjunction with this standard:

IPC-T-50	Terms and definitions for interconnecting and packaging electronic circuits
IPC-PC-90	General requirements for implementation of statistical process control
IPC-QL-653	Qualification of facilities that inspect/test printed boards, components and materials
ANSI/NCSL Z540-1-1994	General requirements for calibration laboratories and measuring test equipment
T 410 om-83	Grammage of paper and paperboard (weight per unit area)
T 411 om-89	Thickness (caliper) of paper, paperboard, and combined board
T 437 om-96	Dirt in paper and paperboard
T 456 om-87	Wet tensile breaking strength of paper and paperboard
T 1007 om-92	Sample location
T 1009 om-92	Tensile strength and elongation at break
ISO 10012-1	Quality assurance requirements for measurement equipment — Part 1 : Meteorological confirmation system for measuring equipment
JIS P 8113-1998	Paper and board — Determination of tensile properties
JIS P 8118-1985	Test method for thickness and bulk density of paper and paperboard
JIS P 8124-1976	Determination of basis weight of paper (Reaffirmed: 1995)
JIS P 8110	Conditioning of paper for test
JIS P 8145	Testing method for dirt in paper and paperboard

Indian Standard

SPECIFICATION AND CHARACTERIZATION METHODS FOR NONWOVEN PARA-ARAMID REINFORCEMENT

1 SCOPE

This specification covers the requirements for nonwoven para-aramid reinforcement used in the manufacture of base materials primarily for rigid or multilayer printed boards in electrical and electronic applications.

1.1 Purpose This specification determines the nomenclature, definitions, general comments, and physical requirements for reinforcement made from nonwoven para-aramid fibers.

1.2 Classification This specification provides physical characteristics of the reinforcement required to meet the design and performance requirements of the printed wiring boards (PWBs).

At the end of this document are specification sheets, which provide minimum performance levels for physical characteristics of the reinforcements. These are useful for identifying degrees of precision needed to meet design/performance requirements of the PWB of current commercially available nonwoven para-aramid reinforcements.

In the event of conflict between design requirements and levels as defined in this specification, design requirements take precedence.

2 APPLICABLE DOCUMENTS

2.1 IPC[1]

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

IPC-PC-90 General Requirements for Implementation of Statistical Process Control

IPC-QL-653 Qualification of Facilities that Inspect/Test Printed Boards, Components, and Materials

2.2 National Conference of Standards Laboratories (NCSL)[2]

ANSI/NCSL Z540-1-1994 General Requirements for Calibration Laboratories and Measuring Test Equipment

2.3 TAPPI (Technical Association Pulp & Paper Industry)[3]

T 410 om-83 Grammage of Paper and Paperboard (Weight Per Unit Area)

T 411 om-89 Thickness (Caliper) of Paper, Paperboard, and Combined Board

T 437 om-96 Dirt in Paper and Paperboard

T 456 om-87 Wet Tensile Breaking Strength of Paper and Paperboard

T 1007 om-92 Sample Location

T 1009 om-92 Tensile Strength and Elongation at Break

2.4 International Standards[4]

ISO 10012-1 Quality Assurance Requirements for Measurement Equipment, Part 1 - Meteorological Confirmation System for Measuring Equipment

2.5 Japanese Industrial Standards (JIS)

JIS P8113-1998 Paper and Board – Determination of Tensile Properties

JIS P8118-1985 Test Method for Thickness and Bulk Density of Paper and Paperboard

JIS P8124-1976 Determination of Basis Weight of Paper (Reaffirmed:1995)

JIS P8110 Conditioning of Paper for Test

JIS P8145 Testing Method for Dirt in Paper and Paperboard

3 REQUIREMENTS

3.1 Terms and Definitions Terms and definitions **shall** be in accordance with IPC-T-50, TAPPI, and JIS documents.

3.1.1 Para-Aramid Fiber A continuous filament yarn precision cut to a specified length, which is used for printed wiring board applications. Para-aramid is the generic name used to describe fibers made from wholly aromatic polyamides or amide polymers in which at least 70% of the amide linkages are attached directly to two benzene rings at the para position in the polymer chain.

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[1] IPC, 2215 Sanders Rd, Northbrook, IL, 60062, 847-509-9700, www.ipc.org
[2] NCSL, 1800 30th Street, Suite 305B, Boulder, CO 80301, 303-440-3333, www.ncsl-h9.org
[3] TAPPI, P.O. Box 105113, Atlanta, GA 30348-5113, 770-209-7303, www.tappi.org
[4] ANSI, 11 W. 42nd St., New York, NY 10039, 212-642-4980, www.ansi.org

3.1.2 Binder A thermoset, thermoplastic, and/or co-polymer resin or a meta-aramid particle or fiber and/or para-aramid particle or fiber used to hold the para-aramid fibers together.

3.1.3 Bagginess Material that is distorted, stretched, or deformed in the middle or along the edges.

3.1.4 Caliper Variation Variation in sheet thickness in the width and length, exceeding the product's specification.

3.1.5 Conducting Particles Small foreign particles capable of conducting current.

3.1.6 Edge Tear/Damaged Roll Edge Tears and/or damage to the edge of the reinforcement.

3.1.7 Dents Indentations in the surface of the reinforcement or in the edge of the roll.

3.1.8 Foreign Material Particles of foreign origin or other visible contaminates.

3.1.9 Wrinkles/Folds A permanent fold or ridge in the reinforcement, generally in the machine direction, occurring during processing or rewinding.

3.1.10 Holes/Thin Spots An area in the reinforcement where few or no fibers are present.

3.1.11 Poor Formation Very uneven distribution of fibers in the reinforcement, resulting in a rough surface or appearance.

3.1.12 Bundles Undispersed fiber bundles or clumps.

3.1.13 Soft Roll/Telescoping Roll that has been loosely wound, resulting in an uneven side-to-side hardness and/or evenness.

3.1.14 Weight Variation Basis weight variation in the width and length exceeding the product's specification.

3.1.15 Crease A ridge in the reinforcement that is not a permanent fold.

3.1.17 Tears A rip in the sheet.

3.1.18 Splice A location where two ends of the sheet are joined to form a continuous roll.

3.1.19 High Spots An area of the reinforcement that is thicker than the surrounding areas.

3.2 Physical Requirements

3.2.1 Product Typical physical requirements of nonwoven para-aramid reinforcements are provided at the end of this document in the form of specification sheets. The specification sheets may not cover all of the commercially available nonwoven para-aramid used in base material manufacturing. This specification is not designed to preclude their use in these applications, provided the requirements of Section 3 are met. New specification sheets shall be added as materials and data are made available.

3.2.2 Filament Diameter Para-aramid fiber length and diameter are specified in the specification sheets of this document. If this information is proprietary for a particular product, fiber length and diameter are identified as agreed between user and supplier (AABUS).

3.3 Visual Requirements

3.3.1 Visual/Appearance Procedures Reinforcements shall be inspected across the full width of the sheet. The reinforcement shall be of uniform appearance and formation. The lighting source should be mounted behind the viewing surface of the reinforcement so as to illuminate the reinforcement from the back with perpendicular light.

3.3.2 Visual/Appearance Defects Count all defects except where two or more defects represent a single local condition (all within one linear meter). In this case, count only the more serious defect as one defect. A continuous defect is counted as one defect for each linear meter or fraction thereof in which it appears. Classify the defects as listed in Table 3-1. Table 3-2 lists the test methods and procedures used to determine values found in the applicable specification sheets.

Table 3-1 Defect Classifications

Defect	Major	Minor
Bagginess		•
Weight Variation	•	
Caliper Variation	•	
Conducting Particles	•	
Edge Tears	•	
Dents		•
Foreign Material	•	
Wrinkles/Folds	•	
Holes	•	
Poor Formation	•	
Bundles		•
Soft Roll/Telescoping		•

Table 3-2 TAPPI and JIS Test Methods and Procedures

Test Method	Procedure Number
Sample Location	T 1007 or applicable procedure
Test Conditions	JIS P8110 or applicable procedure
Thickness	T 411 or JIS P8118-1985
Basis Weight	T 410 or JIS P8124-1976
Tensile Strength	T 1009 or JIS P8113-1998
Solvent Tensile[5]	T 456 or applicable procedure
Contamination	T 437 or JIS P8145
Wet-Out[6]	See footnote

3.3.3 Contamination Requirements Contaminants **shall** be inspected in accordance with 4.3.3 and **shall not** exceed more than three particles/m^2.

3.4 Dimensional Requirements

3.4.1 Roll Length The roll length **shall** be measured by the clock method or equivalent. The roll will be measured from beginning to end, and the length **shall** be reported to the nearest meter.

In the clock method, the measuring device consists of a wheel or pair of wheels mounted on a free-running axle, connected to a counting mechanism graduated to read in meters. The surfaces of the wheels are to be covered with a friction material to prevent slippage. The circumference of the wheel is to be known and synchronized with a mechanism to read in meters. The measuring device is to be mounted in such a way that movement of the reinforcement through the machine will turn the wheels.

3.4.2 Roll Width Place the roll of reinforcement in the horizontal position. Measure the width to within 3.2 mm perpendicular to the edges using steel tape.

3.5 Electrical Requirements The sheet **shall** be free of conductive contaminants.

3.6 Chemical Requirements[7] There are no chemical requirements specified in this document.

4 QUALITY ASSURANCE

4.1 Responsibility for Inspection Unless otherwise specified in the purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. The supplier is responsible for documenting supplier's test methods and sample conditions if they differ from standard TAPPI and JIS test methods. Except as otherwise specified in the purchase order, the supplier may use their own or any other facility suitable for the performance of the inspection requirements herein, unless disapproved by the procuring authority. The procuring authority reserves the right to perform any of the inspections set forth in the specification, where such inspections are deemed necessary, to assure supplies and service are performed to the prescribed requirements.

4.1.1 Test Equipment and Inspection Facilities Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection **shall** be established and maintained by the supplier. The supplier **shall** perform the establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment **shall** be in accordance with ISO 10012-1, ANSI/NCSL Z540-1-1994, or another calibration system agreed upon between the user and supplier.

4.1.2 Standard Laboratory Conditions Unless otherwise specified herein, all inspections **shall** be performed in accordance with the test conditions specified in the general requirements of IPC-QL-653 and the applicable TAPPI or JIS procedures (see Table 3-2). The supplier is responsible for documenting supplier's sample conditions if they differ from standard TAPPI and JIS test methods. If a referee method is required, it **shall** be agreed upon between user and supplier.

4.2 Preparation of Samples Unless otherwise specified herein, samples **shall** be prepared in accordance with standard TAPPI or JIS procedures (see Table 3-2). The supplier is responsible for documenting supplier's sample preparation procedures if they differ from standard TAPPI and JIS test methods. If a referee method is required, it **shall** be as agreed upon between user and supplier.

4.3 Inspection Procedure All rolls **shall** be inspected per 4.3.1. Visual defects are classified in Table 3-1.

4.3.1 Classification of Major and Minor Visual Defects

4.3.1.1 Major Defect A major defect is a defect that is likely to result in failure or materially reduce the usability of the unit of product for its intended purpose (see Table 3-1).

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[5] Substitute solvent for water saturation. The type of solvent should be agreed upon between user and supplier.

[6] It is recommended the user request samples of the nonwoven reinforcement from the supplier to evaluate wet-out characteristics and ensure compatibility with current processes and resin systems.

[7] Exposure to dimethyl formamide (DMF) and N-methyl-2-pyrrolidone (NMP) solvents are not recommended for nonwoven para-aramid reinforcements that contain a meta-aramid binder. Nonwoven para-aramid reinforcement is compatible with other industry standard solvents and chemicals.

4.3.1.2 Minor Defect A minor defect is a defect that is not likely to materially reduce the usability of the unit of product for its intended purpose (see Table 3-1).

4.3.2 Sampling Plans Sampling plans sufficient to ensure an acceptable quality **shall** be used (see Table 4-1).

Table 4-1 General Inspection

Number of Rolls Shipped	Minimum Number of Rolls Inspected
2-8	2
9-15	4
16-25	6
26-50	16
51-91	23
91-150	38

4.3.3 Contamination Inspection A representative sample **shall** be inspected from each production roll for foreign contamination using TAPPI T437, JIS P8145, or some other suitable test method agreed upon between user and supplier. The supplier is responsible for documenting the supplier's test methods and sample conditions if they differ from standard TAPPI and JIS test methods.

4.4 Acceptability Quality Level (AQL) No one meter will be penalized with more than one major defect. A continuous defect **shall** be counted as one defect for each meter or fraction thereof in which it occurs. Latent defects or defects that appear during and after treating can occur to make the product unacceptable for its intended use. The acceptable level of these defects and the resolution of any rejects arising must be negotiated between user and supplier.

4.5 Statistical Process Control (SPC) SPC utilizes systematic statistical techniques to analyze a process or its outputs. The purpose of these analyses is to take appropriate actions to achieve and maintain a state of statistical control and to assess and improve process capability. The primary goal of SPC is to continually reduce variation in processes, products, or services in order to provide product meeting or exceeding real or important customer requirements.

Implementation of SPC **shall** be in accordance with IPC-PC-90.

Depending on the progress made in implementing SPC on a particular product, an individual supplier may demonstrate compliance to specification with any of the following:

- Quality Conformance Evaluations
- End-Product Control
- In-Process Product Control
- Process Parameter Control

An individual supplier may choose to use a combination of the four assurance techniques listed to prove compliance. For example, a product with 15 characteristics may meet specifications by quality conformance evaluations on two characteristics, in-process evaluations on five characteristics, and process parameter control for five characteristics. The remaining three characteristics meet specifications by a combination of in-process control and quality conformance evaluations. Evidence of compliance to the specification at the level of SPC implementation claimed may be audited by the customer or appointed third party.

Requirements are dynamic in nature and are based on what is accepted in the worldwide market. Requirements may be stated as a reduction of variation around a target value, as opposed to just meeting the specification, drawing, etc.

5 PREPARATION FOR DELIVERY

5.1 Roll Size The outside diameter, width, and core size **shall** conform to the customer's specification.

5.1.1 Roll Length Roll length **shall** be determined in accordance with 3.4.1 and **shall** be as specified on the purchase order (min-max roll length). Roll diameter may be substituted for roll length as a means of specifying roll size.

5.1.2 Roll Width Roll width **shall** be determined in accordance with 3.4.2 and **shall** be as specified on the purchase order. The width of the reinforcement **shall** be within –0 +6.4 mm of the value specified or as agreed upon between the user and supplier.

5.2 Splices There **shall** be a maximum of one splice per 500 meters, unless otherwise agreed to or specified per purchase order, with the splice not being within 75 m of the beginning or end of the roll. All splices may be flagged upon agreement between supplier and user and **shall** be compatible with resin solvents. Splices **shall not** lose strength and **shall** withstand treater stresses and temperatures. When two pieces of reinforcement are spliced together, the allowable weight difference per square meter of the two pieces **shall not** be greater than the weight tolerances tested in the appropriate specification sheet.

5.3 Preservation and Packaging Preservation and packaging **shall** be in such a manner as to ensure delivery in a condition that will pass the requirements of this specification.

5.4 Packing Packing **shall** be as specified.

5.5 Labeling In addition to any special labeling required by the contract or order, each roll **shall** be labeled clearly to assure product identity. The label **shall** be located on the box, roll, and core to assure product identity. The label should include a lot number to maintain traceability.

6 NOTES

6.1 Ordering Data The purchase order should specify the following:

(a) Product grade code designation (from specification sheet)

(b) Basis weight required

(c) Roll size: outside diameter, width, and length

(d) Core inside diameter size (i.e., 76.2 mm or 152.4 mm I.D.)

(e) Customer purchase order number

(f) Special labeling instructions

(g) Special packing instructions

(h) Ship-to address

(i) Purchaser's part number, if required

(j) Quantity: total weight and/or length

(k) Any deviations from this specification

6.2 New Reinforcements A new or altered nonwoven para-aramid reinforcement **shall** be considered for addition to IPC-4411 when the appropriate designations are listed in specification sheets and submitted to the IPC office. The IPC office and Nonwoven Aramid Reinforcement Task Group chairman **shall** make the determination to approve the request and ballet the task group. If approved, the new reinforcement **shall** be in the next printing of IPC-4411, and a written notification **shall** be made to the Nonwoven Aramid Reinforcement Task Group members of record of the addition.

Specification Sheets for Nonwoven Para-Aramid Reinforcements

Specification Sheet #	Description
01	Nonwoven Aramid E-210 Para-Aramid Meta-Aramid
02	Nonwoven Aramid E-220 Para-Aramid Meta-Aramid
03	Nonwoven Aramid E-230 Para-Aramid Meta-Aramid
04	Nonwoven Aramid 2.0N710 Para-Aramid Meta-Aramid
05	Nonwoven Aramid 3.0N710 Para-Aramid Meta-Aramid
06	Nonwoven Aramid 4.0N710 Para-Aramid Meta-Aramid
07	Nonwoven Aramid N718 Para-Aramid Meta-Aramid
08	Nonwoven Aramid APX-72 Para-Aramid Meta-Aramid Chopped Strand and Thermoset Resin
09	Nonwoven Aramid APX-50 Para-Aramid Meta-Aramid Chopped Strand and Thermoset Resin
10	Nonwoven Aramid AP-72 Para-Aramid Thermoset Resin

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet
Specification Sheet # : IPC-4411/01
Reinforcement Type : Nonwoven Aramid
Reinforcement Designation : E-210
Fiber Identification : Para-Aramid
Binder Identification : Meta-Aramid
Fiber Identification : AABUS

Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight	-	g/m^2	T 410 or JIS P8124-1976	3.3.2
nominal	31			
minimum	28			
maximum	34			
2. Thickness	-	µm	T 411 or JIS P8118-1985	3.3.2
nominal	43			
minimum	37			
maximum	50			
3. Tensile minimum	-	kg/cm	T 1009 or JIS P8113-1998	3.3.2
MD	0.3			
CD	0.3			
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier
Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet
Specification Sheet # : IPC-4411/02
Reinforcement Type : Nonwoven Aramid
Reinforcement Designation : E-220
Fiber Identification : Para-Aramid
Binder Identification : Meta-Aramid
Fiber Identification : AABUS

Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight	-	g/m^2	T 410 or JIS P8124-1976	3.3.2
nominal	54			
minimum	50			
maximum	59			
2. Thickness	-	µm	T 411 or JIS P8118-1985	3.3.2
nominal	73			
minimum	62			
maximum	83			
3. Tensile minimum	-	kg/cm	T 1009 or JIS P8113-1998	3.3.2
MD	0.82			
CD	0.82			
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier
Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet
Specification Sheet # : IPC-4411/03
Reinforcement Type : Nonwoven Aramid
Reinforcement Designation : E-230
Fiber Identification : Para-Aramid
Binder Identification : Meta-Aramid
Fiber Identification : AABUS

Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight	-	g/m²	T 410 or JIS P8124-1976	3.3.2
nominal	68			
minimum	63			
maximum	73			
2. Thickness	-	µm	T 411 or JIS P8118-1985	3.3.2
nominal	90			
minimum	80			
maximum	100			
3. Tensile	-	kg/cm	T 1009 or JIS P8113-1998	3.3.2
minimum	1.3			
MD	1.3			
CD				
4. Solvent Tensile		kg/cm	T 456	3.3.2
minimum				
MD	AABUS			

AABUS = As Agreed Between User and Supplier
Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet
Specification Sheet # : IPC-4411/04
Reinforcement Type : Nonwoven Aramid
Reinforcement Designation : 2.0N710
Fiber Identification : Para-Aramid
Binder Identification : Meta-Aramid
Fiber Identification : AABUS

Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight	-	g/m²	T 410 or JIS P8124-1976	3.3.2
nominal	31			
minimum	28			
maximum	34			
2. Thickness	-	µm	T 411 or JIS P8118-1985	3.3.2
nominal	51			
minimum	44			
maximum	58			
3. Tensile	-	kg/cm	T 1009 or JIS P8113-1998	3.3.2
minimum	0.76			
MD	0.76			
CD				
4. Solvent Tensile	-	kg/cm	T 456	3.3.2
minimum				
MD	AABUS			

AABUS = As Agreed Between User and Supplier
Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet
Specification Sheet # : IPC-4411/05
Reinforcement Type : Nonwoven Aramid
Reinforcement Designation : 3.0N710
Fiber Identification : Para-Aramid
Binder Identification : Meta-Aramid
Fiber Identification : AABUS

Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 50 45 54	g/m^2	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 74 62 85	µm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 1.4 1.4	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier
Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet
Specification Sheet # : IPC-4411/06
Reinforcement Type : Nonwoven Aramid
Reinforcement Designation : 4.0N710
Fiber Identification : Para-Aramid
Binder Identification : Meta-Aramid
Fiber Identification : AABUS

Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 68 63 73	g/m^2	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 102 87 116	µm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 2.0 2.0	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier
Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet
Specification Sheet # : IPC-4411/07
Reinforcement Type : Nonwoven Aramid
Reinforcement Designation : N718
Fiber Identification : Para-Aramid
Binder Identification : Meta-Aramid
Fiber Identification : AABUS

Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight	-	g/m^2	T 410 or JIS P8124-1976	3.3.2
nominal	72.0			
minimum	70.0			
maximum	74.0			
2. Thickness	-	µm	T 411 or JIS P8118-1985	3.3.2
nominal	115			
minimum	108			
maximum	123			
3. Tensile	-	kg/cm	T 1009 or JIS P8113-1998	3.3.2
minimum	2.0			
MD	2.0			
CD				
4. Solvent Tensile	-	kg/cm	T 456	3.3.2
minimum				
MD	AABUS			

AABUS = As Agreed Between User and Supplier
Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet
Specification Sheet # : IPC-4411/08
Reinforcement Type : Nonwoven Aramid
Reinforcement Designation : APX-72
Fiber Identification : Para-Aramid
Binder Identification : Meta-Aramid Chopped Strand and Thermoset Resin
Fiber Identification : AABUS

Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight	-	g/m^2	T 410 or JIS P8124-1976	3.3.2
nominal	72.0			
minimum	69.5			
maximum	74.5			
2. Thickness	-	µm	T 411 or JIS P8118-1985	3.3.2
nominal	117			
minimum	102			
maximum	132			
3. Tensile	-	kg/cm	T 1009 or JIS P8113-1998	3.3.2
minimum	2.0			
MD	2.0			
CD				
4. Solvent Tensile	-	kg/cm	T 456	3.3.2
minimum				
MD	AABUS			

AABUS = As Agreed Between User and Supplier
Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet
Specification Sheet # : IPC-4411/09
Reinforcement Type : Nonwoven Aramid
Reinforcement Designation : APX-50
Fiber Identification : Para-Aramid
Binder Identification : Meta-Aramid Chopped Strand and Thermoset Resin
Fiber Identification : AABUS

Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 50.0 48.0 52.0	g/m²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 83.3 72.5 94.2	µm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 1.4 1.4	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

AABUS = As Agreed Between User and Supplier
Specifications may be updated to suit users' needs as technology requirements change over time.

NONWOVEN ARAMID REINFORCEMENT REQUIREMENTS

Specification Sheet
Specification Sheet # : IPC-4411/10
Reinforcement Type : Nonwoven Aramid
Reinforcement Designation : AP-72
Fiber Identification : Para-Aramid
Binder Identification : Thermoset Resin
Fiber Identification : AABUS

Requirement	Specification	Units	Test Method	Ref. Para.
1. Basis Weight nominal minimum maximum	- 72.0 69.5 74.5	g/m²	T 410 or JIS P8124-1976	3.3.2
2. Thickness nominal minimum maximum	- 117 102 132	µm	T 411 or JIS P8118-1985	3.3.2
3. Tensile minimum MD CD	- 2.0 2.0	kg/cm	T 1009 or JIS P8113-1998	3.3.2
4. Solvent Tensile minimum MD	- AABUS	kg/cm	T 456	3.3.2

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